Morphology, chromosome numbers and growth condition of *Micranthes fusca* (Maxim.) S.Akiyama et H.Ohba (Saxifragaceae)

Tomoko FUKUDA

Abstract

Herbarium studies and field surveys were conducted to investigate the morphology and growth conditions of *Micranthes fusca*. On the basis of inflorescence hairs as a marker to distinguish variety, the boundary between var. *fusca* and var. *kikubuki* seems to pass around the central part of Yamagata prefecture of Japan. The flower's petal color was mostly dark red. In southern E. Hokkaido, Aomori, and Kyushu, however, greenish white petals were found. The result of chromosome count from 23 localities was 2n = (ca.) 30 except for Kunashir of the Kuril Islands (2n = 30, 45, 60) and Shizukuishi, Iwate (2n = ca.45).

Micranthes fusca is often found in the lowlands of Hokkaido and in the high mountains of central Honshu region, but it also grows in the mountains of Kinki and Kyushu regions. Warmth Index (WI) of each locality ranged from 11.9° to 87.4°, covering vegetation zones from subalpine meadow to the deciduous broad-leaved forest. Though high WI values were expected for Kinki and Kyushu regions, similar values were also found in other areas in Honshu in most cases. However, extremely high values of WI = 79.1°, 87.4°were found in only some populations in Kyushu, which should be the focus of further studies.

Introduction

Micranthes fusca (Maxim.) S.Akiyama et H.Ohba is a perennial plant of the genus *Micranthes* in the family Saxifragaceae. It is distributed to Kyushu, Shikoku, Honshu (Kinki region to the north), Hokkaido, and the Kuril Islands.

Micranthes fusca, unlike other species of the genus as *M. nelsoniana* (D. Don) Small and *M. japonica* (H. Boissieu) S. Akiyama et H. Ohba, has a unique color of flower petals: dark to pale red or greenish white. The shape of the flower is actinomorphic, with thick floral disc and with filaments, less than half of the petal length (Ohwi 1953, Ohba 1989, Wakabayashi 2001). These flower colors and shapes are considered to be an adaptation to the pollinators as fungus gnats (Mochizuki & Kawakita 2017).

Based on the morphological characteristics, *M. fusca* seems to be distributed from Kyushu to Simushir Island in the central Kuril Islands (Barkalov 2009, Takahashi 2015; based on specimens). However, phylogenetic analysis revealed that the plants, occurring from southern Iturup Island to the north, are genetically different from *M. fusca* (Fukuda, unpublished). Therefore, the range of *M. fusca* in this study was set from Kyushu to the southern part of the Kuril Islands (Iturup, Stokap) (Fig. 1, ① as boundary).

Micranthes fusca is abundant in high mountains of central Honshu and in the low elevations from Eastern Hokkaido to the southern Kurils. The distribution is similar to that of so-called alpine plants, but it also disjunctly occurs in the mountains of Kinki and Kyushu, showing a different distribution pattern from ordinary alpine

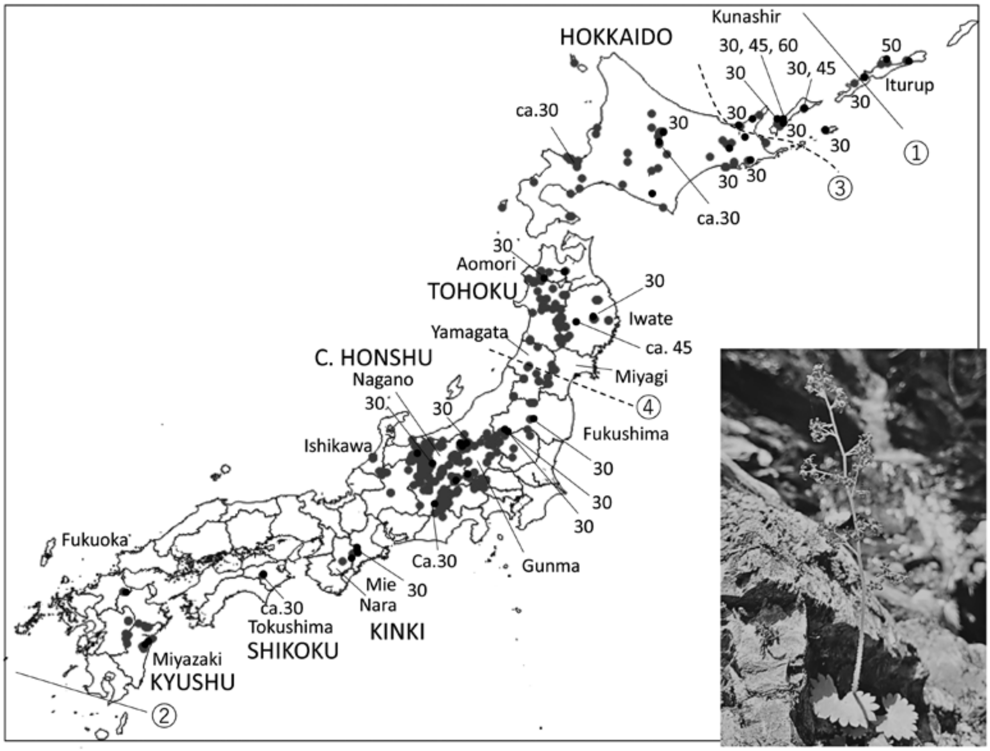

Fig. 1. Distribution of *Micranthes fusca* and chromosome number of them from each locality. Gray circles show the distribution of *M. fusca* on the basis of herbarium specimens. Black circles are localities, visited by author. Numbers indicate somatic chromosome numbers (2n). ① Northern limit of distribution of *M.fusca* on the basis of genetic analysis. ② Southern limit of distribution. ① - ③ Distribution of: *M. fusca* var. *kurilensis*, ③ - ④ : *M. fusca* var. *fusca*, ④ - ② : *M. fusca* var. *kikubuki*. Photography: by Tadahiro Uchida.

plants. Therefore, in order to recognize its unique distribution, the growth conditions of *M. fusca* was investigated by field studies and on the basis of herbarium materials. As *M. fusca* often occurs in wet conditions as riversides or among wet rocks, temperature condition was focused as more important factor for its occurrence than precipitations or other conditions. Taxonomically, *M. fusca* is divided into three varieties (var. *kurilensis*, var. *fusca*, var. *kikubuki*) according to the morphology of hairs on inflorescence branches and pedicels (glabrous, glandular hairs, non-glandular hairs, respectively). So these hairs were examined and flower color was studied. Previous studies have shown that chromosome number is generally 2n = 30 except for some plants in northern Kunashir Islands (2n=45, 60, e.g. Fukuda et al. 2014). In this study, chromosome numbers were additionally investigated for newly collected samples.

Materials and Methods

The distribution of *M. fusca* was shown on map, using QGIS (https://qgis.org/) and the data from "Science Museum Net (S-Net)", the integrated database for natural collections from nearly 100 museums and herbariums (http://science-net.kahaku.go.jp/). In addition to the author's personal collection, 133 specimens from the following herbaria were studied for morphological study and for label information: Fukushima University

(FKSE), Iwate Prefectural Museum (IPMM), Osaka Museum of Natural History (OSA) and Yamagata Prefectural Museum (YAMA). Morphological study on the characteristics of inflorescence hairs and flower colors was performed on these specimens and collections. The chromosome numbers were studied by standard root tip squash method on the collected individuals (Fukuda et al. 2014).

Warmth Index (WI: Kira, 1948), showing the level of warmth, was calculated as follows: select month with average monthly temperature prevailed 5℃, decrease 5℃ from each value, and calculate their total annual value, i.e.Σ (Ti – 5), where Ti. means average temperature of month i., prevailing 5℃. In order to calculate Warmth Index (WI: Kira, 1948) of each location, average monthly temperature data of 1981-2010 was adopted from the site of Japan Meteorological Agency (https://www.data.jma.go.jp/obd/stats/etrn/), for the Kuril Islands from Climatebase.ru (http://climatebase.ru/). The exact localities of *M. fusca* were determined by selecting specimens with precise label information. Locality data of Science Museum Net was also used. The Geographical Survey Institute map (https://maps.gsi.go.jp/) of the Geospatial Information Authority of Japan was used to decide elevation of the locality. From climate data, temperature data of the nearest meteorological station was adopted. Temperature of each plant location was presumed, taking into account the elevation difference between the locality and the meteorological station as -0.55℃ for every 100 m vertical ascending (Kira 1948).

Results

Results are shown in Table 1. As a result of morphological observation, plants with glabrous (hairless) inflorescences were found in southern Kurils and Eastern Hokkaido (Shiretoko)(Fig.1 ① - ③), with glandular hairs from Hokkaido to Tohoku regions (Fig.1 ③ - ④), with non-glandular hairs from southern Tohoku to Kyushu regions (Fig.1 ③ - ④). Both types of hairs, glandular and non-glandular, were observed from Mt. Gassan (Yamagata prefecture). Most of the flower colors were red, but greenish white ones were locally found in southern Hokkaido (around Kushiro and Sapporo), Tohoku (Aomori prefecture), and Kyushu regions. The chromosome number was 2n = 30 (Fig. 2) or ca.30 except for the count of 2n = ca. 45 from Shizukuishi, Iwate and 2n=ca. 30, 45, 60 from Kunashir of the Kuril Islands (Table 1, Fig. 1).

Figure 3 shows the relationship between latitude and WI values of each locality. The Warmth Index (WI) ranged from 11.9°to 87.4°. Low WI values less than 15°were observed in high mountains in Hokkaido (11.9°)

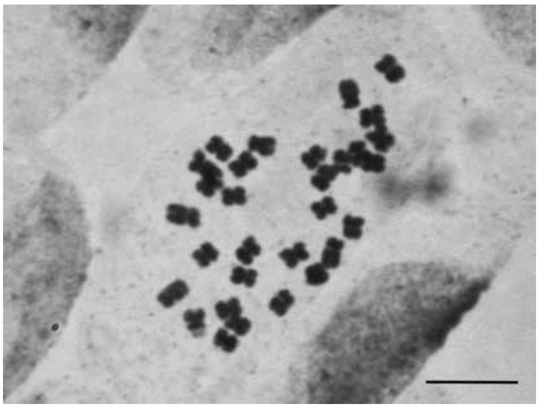

Fig. 2. Somatic metaphase chromosomes of *Micranthes fusca* from Onbetsu, Hokkaido (2n=30). Bar =5μm.

and Ishikawa (12.8°). High WI values around 70°or more were observed in Aomori (Nishimeya, 69.8°), Iwate (Shizukuishi 69.7°), Gunma (Annaka-shi, 77.5°) and in Kyushu (Miyazaki 79.1°; Fukuoka 87.4°).

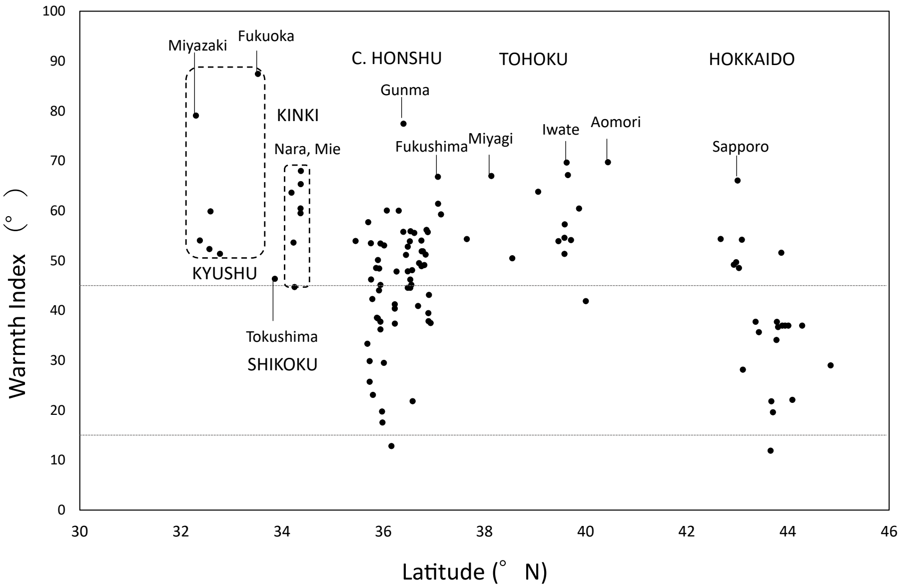

Fig. 3. Scatter plot chart, showing Warmth Index (WI) values in relation to latitude. Line of WI=45 indicate approximate limit between coniferous and broad-leaved deciduous forests. Line of WI=15: approximate forest limit. WI values are shown in Table 1.

Table 1. Morphology, chromosome numbers and habitat of *Micranthes fusca* (Maxim.) S.Akiyama et H.Ohba

Vouchers*1	Locality	alt. (m)	Habitat	Vegetation	Hair *2	Fl.col *3	Chr N *4	WI *5
VLA(s.n.)	Kuril Islands, Iturup, Stokap	300	streamside	nd	N	R	30(1)	29
VLA(s.n.)	Kuril Islands, Kunashir, Tyatina	20	riverside	Abies-picea forest	N	R	30(4), 45(4)	37
VLA(s.n.)	Kuril Islands, Kunashir, Stolbovsky	30	riverside	Abies-picea-decideous forest	N	R	30(10)*, 45(1)*, 60(1)	37
VLA(s.n.)	Kuril Islands, Kunashir, Znamenka	10	wet slope	coastal meadow	N	R	30(1)	37
VLA(s.n.)	Kuril Islands, Kunashir, Andreevka	10	riverside	Abies-picea forest	N	R	30 (3)*	37
VLA(s.n.)	Kuril Islands, Shikotan, Ploskaya	200	riverside	shrubs	N	R	30 (1)*	36.7
T.F.	Hokkaido, Shari	130	riverside	Abies-picea forest	N	R	30 (1)*	51.6
OSA192964	Hokkaido, Mt. Sharidake	550	nd	nd	N	R		37.7
OSA193923	Hokkaido, Mt. Rausu-dake	1100	nd	nd	N	R		22.1
T.F.	Hokkaido, Mts. Taisetsu-zan	1950	spring	alpine meadow	G	R	c30(1)	11.9
T.F.(observed)	Hokkaido, Mts. Taisetsu-zan	1500	riverside	Abies-picea forest	nd	R		21.8

T.F.(observed)	Hokkaido, Mts. Taisetsu-zan	1600	along pass	nd	nd	R		19.6
T.F.	Hokkaido, Mt. Hirayama	1000	riverside	alpine meadow	G	R	30(1)*, c30(1)	34.1
T.F.	Hokkaido, Kamioboro	40	riverside	Abies-picea forest	G	W	30 (2)*	48.5
KCMH4633*	Hokkaido, Kushiro-shi	0	lakeside	nd	nd	nd		49.7
T.F.	Hokkaido, Onbetsu	20	riverside	nd	G	W	30 (2)	49.2
OSA77125	Hokkaido, Kushiro-shi Oakan	430	nd	on the face of boulder	G	W		35.7
KCMH2911*	Hokkaido, Obihiro-shi	230	nd	nd	nd	nd		54.4
OSA150541	Hokkaido, Tokachi, Kamishihoro	700-800	by stream	shady wet place by stream	G	R		37.8
OSA33827	Hokkaido, Mt. Yubari-dake	1000-1350	nd	Betula ermanii forest	G	R		28.2
T.F.	Hokkaido, Otaru, Mt. Harukayama	550	riverside	Abies-picea-decideous forest	G	P/W		54.2
T.F.	Hokkaido, Sapporo, Tokai Univ. exp.forest	220	riverside	Abies-picea-decideous forest	G	P/W	c30(1)	66.1
T.F.	Aomori, Nishimeya	610	riverside	Fagus forest	G	P	30 (1)	69.8
T.F. (observed)	Aomori, Hakkoda	nd	riverside	nd	nd	W		nd
IPMM168225	Iwate, Kuzumaki-cho	1200	nd	nd	nd	nd(st)		41.9
IPMM213927	Iwate, Mt. Hayachine-san	800	nd	nd	G	R		54.6
T.F.	Iwate, Miyako-shi	730	riverside	decideous forest	G	R	30 (1)	57.3
IPMM213759	Iwate, Mt. Hayachine-san	890	nd	nd	G	R		51.4
IPMM261104	Iwate, Shizukuishi,Hashiba	800	nd	nd	G	P		54.1
T.F.	Iwate, Shizukuishi, Omyojin	380	riverside	decideous forest	G	R	c45(1)	69.7
IPMM261604	Iwate, Shizukuishi, Omyojin	445	riverside	decideous forest	nd	nd(st)		67.2
IPMM241993	Iwate, Wakagun, Nishiwakacho	910	nd	nd	nd	nd		53.9
NAC72940*	Akita, KitaAkita-gun	600	riverside	nd	nd	nd		60.5
YAMA66501	Akita/Yamagata, Mt. Chokaisan	nd	nd	nd	G	R/P		nd
YAMA50262	Yamagata, Mt. Chokaisan	810	nd	nd	G	R		63.8
YAMA23762	Miyagi, Mts.Zao	650	nd	nd	G	P		67
YAMA37354	Yamagata, Mt. Goshoyama	nd	nd	nd	G	R/P		nd
YAMA45163	Yamagata, Okuyamadera	nd	nd	nd	G	P		nd
personal inf.	Yamagata, Mt. Gassan	900	nd	nd	G/H	R		50.5
YAMA23756	Yamagata, Mt. Idesan	nd	nd	nd	H	R		nd
YAMA23757	Yamagata, Mt. Asahidake	nd	nd	nd	H	R		nd
T.F.	Fukushima, Mt. Akatsurayama	1080	riverside	decideous forest	H	R/P	30 (3)*, c30(1)	59.3

T.F.	Fukushima, Minami-Aizu-machi	920	riverside	nd	H	R	30 (1)	61.4
T.F.	Fukushima, Minami-Aizu-machi	780	riverside	nd	H	nd(st)	30 (1)*	66.8
FKSE8555	Fukushima, Hinoemata-mura	1660	nd	nd	H	nd(st)		37.5
FKSE14136	Fukushima, Fukushima-shi	1150	streamside	Fagus forest	H	R		54.4
6167 (OSA)	Fukushima, Minami-Aizu-gun	1600	nd	nd	H	R		39.5
GMNHJ BS31672*	Gunma, Azuma-gun	1500	nd	nd	nd	nd		49.5
GMNHJ BS12407*	Gunma, Midori-shi	1300	nd	nd	nd	nd		55.6
GMNHJ BS8668*	Gunma, Katashina-mura	1830	nd	nd	nd	nd		37.9
GMNHJ BS71867*	Gunma, Tsumagoi-mura	1305	nd	nd	nd	nd		55.9
GMNHJ BS55074*	Gunma, Annaka-shi	940	nd	nd	nd	nd		77.5
SMNH-As9902*	Saitama, Chichibu	1950	nd	nd	nd	nd		38.4
SMNH-As23039*	Saitama, Chichibu	1970	nd	nd	nd	nd		37.8
SMNH-As9903*	Saitama, Chichibu	1946	nd	nd	nd	nd		38.6
SMNH-As1379*	Saitama, Chichibu	1780	nd	nd	nd	nd		44.1
OSA4546	Yamanashi, Minami Alps-shi	2230	in stream	shady very wet stone flank	H	R		33.4
OSA15956	Yamanashi, Minami Alps-shi	1530	nd	nd	H	R		57.7
SMNH-As005650*	Yamanashi, Enzan	1770	streamside	nd	nd	nd		48.5
OSA92053	Niigata, Myoko-shi	1270	nd	cool decideous forest	H	R		55.7
GMNHJ BS11046*	Niigata, Itoigawa-shi	1470	nd	nd	nd	nd		49.1
NAC82017*	Nagano, Togakushi	1220	nd	nd	nd	nd		54
17998 (OSA)	Nagano, Kawakami-mura	1600	streamside	shaded mossy swamp by stream in wooded valley	H	R		48.5
OSA145060	Nagano, Ina-shi, Hasekurogouchi	1870	nd	Abies forest	H	nd(fr)		46.2
OSA28581	Nagano, Mt. Amekazari-yama	1500-1600	snowy valley	nd	H	R		43.2
NAC145813*	Nagano, Susaka-shi	1400	nd	nd	nd	nd		48.1

SHIN40575*	Nagano, Kijimadaira	1460	nd	nd	nd	nd		51.2
TOYA4850*	Nagano, Omachi-shi	1680	nd	nd	nd	nd		45.2
T.F.	Nagano, Sakae-mura	1310	riverside	decideous forest	H	R	30 (1)	56.2
T.F.	Nagano, Yamanouchi, Yomase	1440	riverside	decideous forest	H	R		51.9
T.F.	Nagano, Yamanouchi, Hirao	1530	streamside	decideous forest	H	R		48.9
T.F.	Nagano, Yamanouchi, Hirao	1440	streamside	decideous forest	H	R		51.9
SHIN40641*	Nagano, Kusatsu-toge	1966	nd	nd	nd	nd		40.9
FKSE69571	Nagano, Sugadaira Exp. center	1335	nd	nd	H	R		53.9
T.F.	Nagano, Azumino, Horigane	1360	streamside	Larix-conifer-decideous forest	H	nd(fr)	30(1)	60
SHIN40608*	Nagano, Azumino	1470	nd	nd	nd	nd		55.8
T.F.	Nagano, Suwa-gun Fujimi	1640	streamside	Larix forest	H	nd(fr)		50.1
T.F.	Nagano, Mt. Odaka-yama	1660	riverside	Larix forest	H	R	c30(3)*	54
T.F.	Nagano, Minamimaki-mura	1460	streamside	nd	H	R		53.1
13357 (OSA)	Nagano, Minamimaki-mura	2200	nd	nd	H	R		29.5
18079 (OSA)	Nagano, Chino, Mt.Yatsuga-take	2800	under wet ledge	in rocky alpine edge	H	R		17.6
18107 (OSA)	Nagano, Chino, Mt.Yatsugatake	2700	swampy meadow	by bush in steep ca2700m elev.	H	R		19.8
19910 (OSA)	Nagano, Minamisaku, Kawakami	1450	nd	nd	H	R		53.5
5431 (OSA)	Nagano, Minamisaku, Kawakami	1970	nd	nd	H	R		36.2
23259 (OSA)	Nagano, Minamisaku, Kawakami	1700	very wet rocky slope	moist primitive forest	H	R		45.2
19693 (OSA)	Nagano, Ina-shi, Mt. Senjo-dake	1650	streamside	shady very wet stream-side	H	R		53.5
19864 (OSA)	Nagano, Ina-shi, Mt. Senjo-dake	2550	wet rocky slope	half-shaded thicket side	H	R		25.7
19550 (OSA)	Nagano, Ina-shi, Mt. Senjo-dake	2400	rocky soil in stream	under shrubs	H	P		29.9
SHIN40631*	Nagano, Matsumoto, Kamikochi	2130	nd	nd	nd	nd		37.4
16191 (OSA)	Nagano, Ina-gun Miyada-mura	2000	nd	nd	H	R		42.3
GMNHJ BS66692*	Nagano, Ina-gun Miyada-mura	2670	nd	nd	nd	nd		23.1
SHIN40630*	Nagano, Matsumoto	1809	nd	nd	nd	nd		47.8
SHIN40581*	Nagano, Matsumoto	2008	nd	nd	nd	nd		41.3
SHIN40579*	Nagano, Matsumoto	2034	nd	nd	nd	nd		40.4

T.F.	Toyama, Mt. Tateyama	2280	riverside/ wet slope	alpine shrub/alpine meadow	H	R		21.9
OSA215110	Toyama, Toyamashi Arimine	1100-1400	on stream	nd	H	R		52.8
TOYA44211*	Toyama, Toyamashi Arimine	1300	nd	nd	nd	nd		51.2
TOYA54202*	Toyama, Toyamashi Arimine	1400	nd	nd	nd	W+		47.9
TOYA43276*	Toyama, Toyamashi Arimine	1450	nd	nd	nd	nd		46.2
TOYA32222*	Toyama, Tateyama-cho	1500	nd	nd	nd	nd		44.6
TOYA22603*	Toyama, Toyamashi Arimine	1500	nd	nd	nd	nd		44.6
10804 (OSA)	Ishikawa, Mt. Hakusan	2702	mt top	nd	H	R		12.8
OSA273814	Fukui, Hakusan-shi, Shiramine	1250-1300	nd	nd	H	R		60.1
T.F.	Mie, Matsusaka, Iidaka-cho	1120	streamside	decideous forest	H	R		68
9855 (OSA)	Mie, Matsusaka, Iidaka-cho	1305	streamside	nd	H	R		60.5
T.F.	Mie, Matsusaka, Iidaka-cho	1180	streamside	decideous forest	H	R	30(1)	65.4
T.F.	Mie, Matsusaka, Iidaka-cho	1330	streamside	decideous forest	H	R		59.5
OSA89024	Nara, Yoshino, Kamikitayama	1450	nd	half shaded place on a rock	H	nd(fr)		53.6
OSA192100	Nara, Yoshino, Tenkawa-mura	1700	nd	nd	H	R		44.7
personal inf.	Nara, Yoshino, Tenkawa-mura	1190	riverside	decideous forest	nd	nd		63.6
T.F.	Tokushima, Mima-gun	1670	riverside	Tsuga forest	H	R	c30(1)	46.4
T.F.	Fukuoka, Buzen-shi	750	riverside	decideous forest	H	R		87.4
OSA39379	Fukuoka, Buzen-shi	750	nd	nd	H	R		87.4
KPM-NA197343*	Miyazaki, Gokase-cho	1646	nd	nd	nd	nd		52.3
KPM-NA197381*	Miyazaki, Shiiba-mura	1450	nd	nd	nd	nd		59.9
NAC102448*	Miyazaki, Hinokage-cho	1569	nd	nd	nd	nd		51.4
KPM-NA74707*	Miyazaki, Shiiba-mura	~1607	nd	nd	nd	nd		54.1
T.F.	Miyazaki, Koyu-gun Tsuno-cho	1000	streamside	decideous forest	H	W/P		79.1

1 Harbarium/organization code and No. of specimen. Number with indicates that author used the locality data from S-Net database without seeing the material. T.F.: author's personal collection. Number (OSA) is a number of collectors.

*2 N: without hairs, G.:glandular hairs, H: nonglandular hairs.

*3 Flower color. R: red, P: pink, W: pale green-white. Flower color could not determined in sterile (st) and in fruit (fr). W+ was a specimen of "f. *viridiflora*".

4 Somatic chromosome numbers (2n=). Numbers in ( ) : number of individuals studied. Number with are results of previous studies (Fukuda et al. 2014). c: approximately (ca.)

*5 Warmth Index value (Kira, 1948).

Discussion

As a result of morphological study on inflorescence hairs, both types of hairs were found among the plants in Yamagata prefecture (Mt. Gassan), suggesting that the boundary between varieties *M. fusca* var. *fusca* and var. *kikubuki* is around this area. The distribution of each type of hair is geographically structured, and should be examined in relation to phylogenetic differences.

Micranthes fusca with greenish white petal color is originally described from Mt. Tateyama (var. *viridiflora* Nakai). As far as herbarium work suggested, *M. fusca* often has dark-red petals in Nagano and in Tohoku district (e.g. Iwate and Yamagata). However, in some regions as Hokkaido, Aomori and Kyushu, such flower color is not rare, and even common in South-East region of Hokkaido (e.g. Kushiro, Onbetsu). This study confirmed that plants with greenish white petals are seen among both varieties: var. *fusca* and var. *kikubuki*, not confined to a single variety.

As reported in previous studies (Nishikawa 1985, Funamoto & Nakamura 1990, Fukuda et al. 2014), chromosome number of *M. fusca* was generally 2n=30. Among samples from 23 localities found 2n=45 from Shizukuishi, Iwate and 2n=30, 45, 60 from Kunashir of the Kuril Islands. Their localities are distant from each other, and each of them are considered to be a local variation. The population of Shizukuishi had large number of individuals along the river in relatively low elevation (ca. 400m), with high WI value of 69.7°. It is of interest whether the variation of chromosome numbers has promoted its growth in relatively warm condition, which seems not very optimistic for *M. fusca*.

Kira (1948) considered that the tree line, i.e. limit of the forest zone is around WI=15 ° and the limit line between coniferous and deciduous broad-leaved forest is around WI=45° (or 55°in Hokkaido and some districts of Tohoku) by comparing the Warmth Index and vegetation, though there are some exceptions depending on the tree components and others. Result of this study showed wide range of WI values of *M. fusca* localities, from 11.9°to 87.4°. The result is also supported by field observations and by label information. It grows in various habitats, as above the forest line (e. g. Mts. Taisetsu-zan, Mts. Tateyama), in *Betula ermanii* forests (Shari / Mt. Rausu-dake, Mt. Yubari-dake), in coniferous forests (*Abies*-*Picea*: Kushiro, *Tsuga*: Tokushima), in *Lalix* forests (Nagano) and in deciduous forests (Iwate, Niigata, Mie). These results suggest that occurrence of *M. fusca* is not limited to a specific forest zone, and that the temperature may not be a strict limiting factor for the growth conditions of *M. fusca*. However, considering the tendency that *M. fusca* often grows in the lowlands from Shiretoko (eastern Hokkaido) to the southern Kurils, and has more chances to be found at altitude of 1500 m or higher in the central highlands of Honshu (e. g. Nagano prefecture), the WI value of 15°-60°may be an optimum condition for the growth of *M. fusca*. Indeed, more than 81% of the localities of this study are addressed to this range. This range of values correspond to a part of the deciduous forest zone, up to the limit of forest line.

Considering the habitat of *M. fusca*, preferring cool conditions, the distribution in Kinki and Kyushu regions seems to be very unusual. WI of these regions are 44.7° to 68.0° in Kinki and 51.4° to 87.4° in Kyushu. However, if we see WI of other regions, high WI is not special to Kinki and Kyushu, but are also seen in other localities as in Aomori (69.8°), Iwate (69.7°) and Gunma (77.5°), except for extremely high WI values (WI=79.1°, 87.4°) of Kyushu (Table 1, Fig. 3). WI value in Gunma (77.5°) is also very high, but the author did not examine the specimen yet, using only elevation data. In Kinki, *M. fusca* grows in Mie and Nara prefectures. Observation at these sites revealed that they often form small populations, consisting of 10 to ca. 50 individuals along small streams under the deciduous forest. The riverside environment may provide favorable condition for their growth.

In Nara, however, the population observed 10 years ago was not confirmed by recent field survey, and these habitats seem to be very unstable. Most of these populations of Kinki and Kyushu are common in habitat, growing at the periphery of mountainous areas, and their occurrence may be relicts of past distributions.

Especially high WI values: 79.1°and 87.4°were calculated from Kyushu. WI=87.4°was observed along the river of a mountain in Fukuoka. Though exact locality is unknown, occurrence of *M. fusca* from the same elevation of the mountain was confirmed after 60 years from the previous collection (Table1). As for the population from Kyushu, some taxonomists recognize variety "var. *kyusiana*" for *M. fusca* from Kyushu on the basis of pilose hairs on flower stems, flower colors and other characteristics (Hara, 1939), and further study should be focused on these populations.

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Morphology, chromosome numbers and growth condition of *Micranthes fusca* (Maxim.) S.Akiyama et H.Ohba (Saxifragaceae)

エゾクロクモソウ（ユキノシタ科）の形態・染色体数と生育条件

福　田　知　子

要　旨

日本列島を中心に分布するエゾクロクモソウの形態と生育条件を調べるため、標本・実地調査を行った。変種の指標となる花序の毛（腺毛、普通毛、無毛）を調べた所、山形県の月山に腺毛・普通毛の個体が両方観察されたため、変種のエゾクロクモソウ・クロクモソウの境界は山形中部周辺を通るとみられる。花色（暗赤色、淡赤色、緑白色）は、千島、東北南部、本州中央高地には暗赤色の個体が多く、緑白色の個体はエゾクロクモソウ・クロクモソウの両変種にわたって、道東南部、青森、九州などにみられた。染色体数は過去の結果も含め 23 地点で調査し、千島（2n = 30, 45, 60）、岩手雫石（2n = ca.45）を除き 2n = 30 (ca.30) であった。

種としてのエゾクロクモソウは北海道の針葉樹林下や本州中部の高山に多く見られ、冷涼な気候を好むと考えられる一方、近畿・九州の山地にも分布し、生育条件に関心が持たれる。各生育地の暖かさの指数（WI）を求めた所、WI 値は 11.9°～87.4° まで大きく変化し、生育する植生帯も亜高山草原から落葉広葉樹林帯まで、広範囲にわたっていた。近畿、九州では高い WI 値が予想されたが、多くの場合、同様な値は本州の他の生育地でもみられた。ただし、WI=79.1°, 87.4° という高い値は九州の一部の集団のみで見られたため、今後、これらの集団に注目した検討が必要である。